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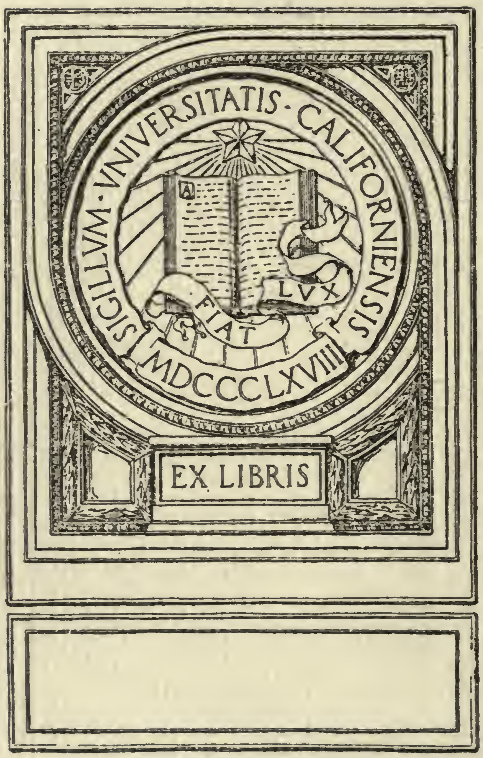

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Employment Opportunities for Handicapped Men in the Optical Goods Industry

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Opportunities for Handicapped Men in the Optical Goods Industry

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Weighing glass for lenses

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Foreword

THIS report on the optical goods industry is one of a series of occupational studies prepared by the Harvard Bureau of Vocational Guidance for the purpose of making available information concerning possible openings for handicapped men. It is the result of a survey of a considerable number of optical manufacturing establishments and prescription shops in New England. Preliminary reports of individual establishments have been placed in the hands of the Federal Board for Vocational Education, The United States Employment Service, and The Vocational Training Division of the Massachusetts Industrial Accident Board, and other agencies interested in the rehabilitation of handicapped persons. In its present form, the report deals with the optical industry in general rather than with any particular establishment, and is published in the hope that it may be of service in the work of restoring to civil and industrial life those who have been injured either in war or in industry.

Opportunities for Handicapped Men in the Optical Goods Industry

Much has been said in the public press about the advantages for disabled men in optical manufacturing establishments. Employers have reported to government officials and to other agencies interested in the rehabilitation of disabled soldiers and sailors that they could offer suitable occupations for practically all types of handicaps except cases of blindness and the loss of the use of the fingers. A careful study of typical plants has brought to light information which justifies these reports in the press and on the part of employers. Some of the principal advantages are as follows:

1. *Light Bench Work.* The making of frames for eyeglasses and goggles offers a large variety of occupations which are done while the worker is seated at a table. The work is light and varied so that interest is easily maintained.

2. *Attractive Working Conditions.* The materials used, such as gold, white metal, tortoise-shell, and steel, are such as to make it possible to keep the working rooms in a clean, attractive condition. No health hazards are introduced by the materials used. As one passes through the establishment, the factories appear more like offices than workshops. This feature is a strong factor in promoting contentment and satisfaction among the operatives.

3. *A High Class of Workers.* The nature of the work and the condition of the factories induce a high class of persons to take up the work. Men and women who are not disposed to work in factories where the materials are necessarily dirty and offer numerous health hazards are often content to work in optical establishments.

4. *Steady Employment.* The manufacture of optical goods offers steady employment the year round. There are no periods of depression or slumps in the industry so that one can count on regular employment. Perhaps no other line of industry is as free from slack periods as is this industry.

5. *A Growing Industry.* During the last few decades, the optical industry has grown very rapidly. The careful supervision of the health of pupils in the public schools has led to extended use of glasses on the part of pupils. The discovery of the fact that many of the physical ailments of pupils are due to defective sight is leading adults also to recognize that weak or defective eyes are the causes of many of their ailments which heretofore have been attributed to other causes. It is estimated that about seven persons out of ten would profit by the use of eyeglasses, while, at the present time, not more than two in ten are using them. The trend of events indicates that the industry will have to expand very rapidly to supply the increased demand for glasses. Leading establishments are making plans to meet an unusual expansion of business as the country returns to the normal conditions of peace.

American optical goods are fast winning their way in all foreign markets. The export trade offers one of the most promising fields for future development. In 1910 more than ninety per cent. of the spectacles, eyeglasses, and ground or finished eyeglass and spectacle lenses and ninety-five per cent. of the spectacle and eyeglass frames used in Canada were imported from the United States. The leading firms in Mexico City state that they buy practically all of their spectacle frames and lenses in the United States because of the better quality of goods for the price and the quicker deliveries. In speaking of the European trade, Consul General Frank H. Mason of Paris says: "The dominant fact that pervades the whole subject is that while French and German makers of optical glass and lenses are unsurpassed, if equalled, by those of any other country, the Americans are far superior as mechanics in skillful construction, shaping, and adjustment of springs, studs, guards, and frames with which they are equipped." Before the war, the American style of pincenez, consisting of glass without rims, was very popular, even in Vienna, the internationally renowned city of eye specialists.

In Paris, the American goods are very popular at the present time because of the so-called gold-filled mountings made of a combination of metals which resembles gold, takes a polish, has the strength and elasticity of steel, and does not tarnish in the presence of moisture. American goods of this kind are so popular in Paris that a number of European firms have endeavored to imitate them and sell them under the name of American goods. In Switzerland, the American frames are very popular though lenses are, for the most part, imported from France and Germany. Before the war, American goods were finding their way into Sweden in large numbers but almost wholly through German houses. More than twenty per cent. of the frames and from twenty to twenty-five per cent. of the lenses used in London before the war were imported from the United States.

Manufacturers of optical goods are of the opinion that the foreign field is much more promising now than before the war. When it is understood that American products were considered superior to foreign goods even before the war, it is only reasonable to expect that the foreign trade will increase rapidly as we return to a peace basis of commerce.

Another field in which material progress has been made since the beginning of the war is in the manufacture of goggles. This is due largely to the increased use in recent years of automobiles and motor-cycles as well as the still more recent development of aeronautics. These new fields are impelling opticians to pay much more attention to the manufacture of a high quality of goggles. With large openings in the foreign field and the increasing use of glasses of all kinds, the optical industry seems to be entering upon an era of unparalleled expansion.

Most of the advantages mentioned above apply especially to the manufacture of frames and cases. Prescription work offers other advantages, a few of which are mentioned in the sections that follow:

1. *Wide Distribution of Shops.* Prescription shops are found in large numbers in practically all towns and cities of any considerable size. This is a decided advantage from the point of view of disabled men as it offers opportunities for the employment of large numbers of men close to their own homes.

2. *Openings for Inexperienced Workers.* Many of the operations are open to beginners without previous experience. These positions pay good wages and at the same time offer opportunities for the workers to become acquainted with the various operations in the entire shop.

3. *The Work is Free From Monotony.* Each operation involves a number of details, which lessens the monotony that is so often connected with operating mechanical machines. Hundreds of different styles of lenses are necessary to meet the demands of the prescription trade so that a worker employed at the same operation is called upon to do many different kinds of work during the day.

4. *Opportunities for Advancement.* The different operations naturally fall into a progressive order of development which enables a worker to advance from one task to another as skill and experience are developed. For instance, employers prefer to take young men to learn the work. They start them as messenger boys, which brings them into touch with all the different departments and enables them to form a clear conception of the work as a whole. From messenger boys, they advance naturally to the work of laying out and, from this, to polishing, grinding, hand edging, and final inspection. A worker who understands the different steps in the manufacture

of articles usually becomes more loyal to the establishment. Labor turn over is considerably reduced by this progressive training of employees.

The work in the manufacture of eyeglasses and goggles naturally falls into three divisions: The manufacture of lenses, the manufacture of frames, and optical prescription work. A few large factories are equipped to do work in all three lines, though most of the prescription work is done in small factories scattered throughout the country.

THE MAKING OF LENSES

Though a large number of operations are involved in the manufacture of lenses, they fall into a few natural divisions. For the purposes of this report it will be necessary to consider only these divisions and not to take up the separate operations in detail. The main divisions are as follows:

1. Preparing Glass Stock.
2. Rough Edging Lenses.
3. Blocking-On.
4. Surface Grinding.
5. Polishing.
6. Picking-Off.
7. Washing.
8. Testing and Gauging.
9. Packing and Shipping.

Preparing Glass Stock. Glass stock comes to the factories either in large sheets or in huge rough chunks. The glass that comes in sheets is cut in convenient sizes for surface grinding. Glass that comes in blocks is broken and weighed into amounts as is required to make the different sizes of lenses. The weighing is usually done on common balance scales; a lens is placed on one side and enough glass to balance it on the other. After the glass has been weighed, it is put into molds and fused into shape.

The worker must be able to read simple instructions and to keep accurate records of the lenses weighed. As a rule, the average man can learn to do the work in two or three weeks, though it takes a much longer time to be able to earn the highest wages. The work requires a considerable amount of walking and lifting, which means that the operator should be fairly free from serious handicaps. Some foremen are of the opinion that a man who had lost a leg below the knee would be able to do the work without loss of efficiency. Defective hearing, the loss of one eye, or the loss of two or three fingers, would not interfere with efficient work. Wages range from $18 to $22 per week.

Rough Edging. During the process of molding some of the glass runs over the edge of the mold and forms in rough strips around the lens. This is removed by use of a composition stone. The lenses are held on the stone by the hand and persons who are experienced can often grind 4,000 or 5,000 lenses in one day. The work requires deftness of finger movements rather than strength. Most factories employ boys from fourteen to sixteen years of age at this operation. They receive $9 per week at the start and after a few weeks' experience many of them earn as high as $25 on piece-work. The work could be done while the operator is seated, though most of the boys prefer to stand. The loss of a leg below the knee, defective hearing, the loss of one eye, hernia in a mild form, or slight trunk injuries would not incapacitate one.

Blocking-On. Blocking-on is a term applied to the work of putting the lenses on a proper block in preparation for the work of grinding. In most factories this work is done by molding concave and convex blocks out of earthen material to the desired size and shape, covering them with hot pitch, and, as the pitch cools, placing lenses in it in rows at regular distances. When the pitch hardens, the block is ready for the grinding machine. The work is not suitable for handicapped men though it would be possible for one who had lost two or three fingers or a leg below the knee to do the work without loss of efficiency. As a rule, it takes a worker two or three weeks to become handy at this operation. Wages range from $18 to $22 per week.

Surface Grinding. Lens factories usually surface lenses on one side only and leave the other side to be finished in prescription shops. This is due to the fact that eyes vary so widely in their defects and power of vision that standard styles can be made only in a very general way. These standard styles must be made so that they can be easily adapted to the peculiar conditions of the eyes of each customer.

For surface grinding modern factories have machinery by means of which one operator can grind a thousand or more lenses at one time. The machines consist of a row of upright spindles attached to one long shaft. The upper end of the spindle is made so as to receive tools of different sizes and shapes. The chief work of the operator is to set the tools and keep them supplied with an emery composition during the process of grinding. Convex lenses are stuck on large convex blocks; concave lenses on concave blocks. The blocks hold from fifty to one hundred lenses, according to the size of the lenses. For grinding convex lenses concave tools are used and vice versa. The block fits into the tool just as the bottom of a saucer fits into the top of another saucer. Automatic appliances are attached to the machine which hold the blocks firmly against the tool as the latter is in motion. The emery composition grinds the lenses into shape but leaves them with rough surfaces.

The work involves a considerable amount of walking and lifting so that the operator must be fairly able-bodied, though one who had only a stump of a hand would be able to do the work without much loss of efficiency.

Defective hearing, the loss of one eye or the loss of three or four fingers would not incapacitate one. As a rule, operators of surface-grinding machines begin work as polishers and are advanced to surface grinding only after they have become skilled at handling polishing machines. It takes an average man six months or more to learn surface grinding and a much longer time to be able to earn the highest wages. Some of the most skilled men make as high as $35 a week.

Polishing. Polishing lenses is done on the same kind of a machine as grinding, the only difference being that rouge is used instead of emery. The work is simple and can be learned in two or three months. Wages are practically the same as for grinding and the operation bears the same relation to handicaps.

Picking-Off. After the lenses have been surfaced on one side they are removed from the block. This work is known as picking-off and is done by holding a block in cold water until the pitch becomes chilled, when the lenses are easily picked off by hand or with a tool similar to a screw-driver. The work is wet and heavy and not suited to men with serious handicaps, though defective hearing, the loss of two or three fingers, or one eye would not interfere with efficient work. Men receive $18 at the start and after a few months' experience make as high as $22 a week by piece-work.

Washing. After the lenses have been picked off they are taken to large tanks, usually four in number, to be washed. The first tank contains a weak solution of acetic acid; the second one, hot water; the third tank, another solution of acid; and the fourth one, cold water. New men can begin the work immediately and in a few weeks are able to earn full pay. This work is not desirable for handicapped men. Wages range from $18 to $20 per week.

Testing and Gauging. After the lenses are thoroughly washed they are tested for curvature and gauged for thickness. This work is done by means of a very simple lens-measuring instrument and while the worker is seated at a table. The work can be learned in a few weeks' time, and offers suitable opportunities for men who have lost a leg above the knee, the loss of three fingers or less on one hand, defective hearing, trunk injuries, or hernia. Persons who have been gassed or who have recovered from shell shock would find this work very satisfactory. Wages average about $20 per week.

Packing and Shipping. Some of the lenses go from the testing-room to the prescription-room while others are packed to be shipped to customers. Packing is light, clean, attractive work. It is usually done by women. It consists of putting each lens in an envelope and tying the envelopes together in packages of one dozen each. The principal qualifications are deftness of finger movements and keenness of eyesight. Experienced women are able to make from $15 to $20 a week at piece-work. The work could be done by men who had lost a leg or who had received serious trunk injuries.

MAKING FRAMES AND CASES

Frames for eyeglasses are made of steel, celluloid, tortoise-shell, white metal, filled gold, and solid gold. The work involves a very large number of separate operations which are not easily classified into typical classes. For the purpose of this report we will group the work under the following headings:

1. Light Press Work.
2. Bench Machine Work.
3. Hand Work.

All three kinds of work are involved in the making of frames regardless of the kind of material used. In what follows, therefore, nothing will be said as to the nature of the material.

Light Press Work. The work of blanking out eyepieces, screen binders, end pieces, cutting temple pieces, and forming bridges is done on machines, usually spoken of as 'A' presses, since the frame is shaped like the letter 'A'. Compared with the press work in machine shops and shoe manufacture this work is comparatively light. Operating the machines may usually be done while the operator is seated. The average person could learn to operate a press satisfactorily in two or three weeks' time, though a longer experience is necessary in order to earn the highest wages. Some of the presses are operated by treadle and some are operated by hand. Treadle presses offer suitable work to men who have lost a leg either above or below the knee, or who have received trunk injuries. There is nothing in the work that would be injurious to a person with arrested tuberculosis. Presses arranged to be operated by hand offer suitable opportunities to legless men as well as the handicaps mentioned above. Wages range from $22 to $25 per week. Modern shops have a large number of heavy presses and are in a position to offer desirable work to a considerable number of handicapped men. A foreman of one of the leading establishments in New England affirms that they can find work for men with any kind of handicaps except blindness and the loss of the use of the fingers.

Bench Machine Work. The work on solid-gold frames, gold-filled frames, steel frames, and gold finger-pieces involves a number of different operations for which single purpose machines have been especially designed. Most of these machines are light bench presses and can be handled easily by women. Skill in repetative finger and hand movements, rather than physical strength is required for efficient work.

Working on gold and white metal is clean, attractive work which draws a high class of employees. As one passes through the plant, the workshops appear more like offices than factories.

The operator of a single purpose machine must learn the work in the shop. To establish a vestibule school would require about as many machines as are found in the main factory, as one machine usually does all of the work of one kind. Women seem better adapted to this kind of work than men, though some establishments employ the latter in considerable numbers. The loss of one or both legs, trunk injuries, or hernia would not interfere with efficient work. The working conditions are such that arrested tuberculosis would not debar one from this operation. It is difficult to make any definite statement in regard to the time required to learn the work. Some of the operations require a much longer time than others and people differ in their ability to learn to operate the single purpose machines. It is safe to say that it would take an average person two months or more to become an experienced worker. Wages differ very greatly. Some operations pay from $10 to $12 while others pay as high as $25 per week.

Hand Work. Assembling the various parts of eyeglasses and goggles offers employment to a large number of workers. Handling the small parts like screws and eyepieces is tedious work for which women seem better adapted than men. The work is very light but requires extraordinary deftness of finger movements and keenness of eyesight. The work is brought to the assembling table by the service boys so that the worker is seated all day long. For men who have had experience in watch or jewelry-making, this operation offers very attractive opportunities. Employers of leading establishments are willing to employ handicapped men at assembling work and will give them a fair trial in order to see if they can do the work satisfactorily. It is safe to say that anyone who is adapted to fine hand work of this kind would be able to find work which he could do. Good wages are paid to beginners, and workers who are quick and accurate can earn by piece-work $25 or more per week.

Cases. Cases for single pairs of glasses are made of steel, leatherette, leather, and white metal. The work is done on presses while the operator is seated. No heavy lifting is required so that men who have serious injuries to the legs or trunk organs would find the work very satisfactory. Quickness of movement rather than muscular strength is required. Men and women are employed in about equal numbers. Some employers are anxious to try handicapped men on this work. They are of the opinion that men who have lost a leg, a hand, or who have received serious muscular injuries could be fitted into positions where they would make good wages. The conditions are such that men who have been gassed or who have arrested tuberculosis might find the work satisfactory. Some foremen make the sweeping statement that they could place men with any kind of a handicap save the loss of the use of most of their fingers or blindness. Wages vary greatly; some operations pay as high as $28 or $30 while others pay as low as $12 to $15 per week.

Packing and Shipping. Gold-filled and solid-gold frames are, as a rule, packed in individual packages and shipped by parcels post. Other frames and cases are carefully wrapped and packed in cases containing several dozen pairs. The work of wrapping and packing is done, as a rule, by women who receive from $12 to $15 per week. The only operations at which men work are those of handling the cases and helping store the packages on the labeled shelves which often extend nearly to the ceiling of the store-room, hence the work of packing offers very little opportunity to handicapped men.

PRESCRIPTION WORK

Optical companies which do prescription work are found in considerable numbers in all large cities, and branches are located in smaller cities and towns throughout the country. The prescription optician is becoming about as necessary as the pharmacist. And just as the latter fills the medical prescriptions to order, so the former fits glasses to order. The work involves a number of operations, the most important of which will be treated in the following sections.

Laying Out. The first operation in connection with prescription work is the selection of the lenses to fill the orders received for the day. This work is done in some shops by women and in others by men. It consists, first, in taking the orders as received and writing them out in the technical language of the shop; and second, in selecting the proper lenses to fill each prescription. Sometimes the person who does the work of laying out gives directions to other workers in the plant. When this is the case, the one who does the work of laying out is the foreman of the grinding department. Combining the work of foreman with laying out requires that the employee should be fairly able-bodied. He must move about the room constantly and be able to assist new men in their work.

When, as is frequently the case, one person works at laying out only, the operation offers suitable opportunities for one who has lost one or both legs as the work can be done seated at a table. Deafness, weak kidneys, hernia, or arrested tubercular trouble would not interfere with efficient work. Two arms, two hands, and not less than eight fingers are necessary for satisfactory work. Wages range from $10 to $18 per week.

Blocking-On. The work of blocking-on consists in fastening lenses to metal blocks in preparation for grinding. For this purpose Burgundy pitch is used, which not only fastens the lens firmly to the block but forms an opaque background which enables the operator to note any defects in the work of grinding. Wages are from $8 to $10 to start, and experienced men make from $20 to $22 per week by piece-work. The loss of three or four fingers, one leg, deafness, weak kidneys, or hernia would not be serious handicaps. The opportunities for advancement to grinding and polishing are good, and men who show an interest in their work are usually advanced to other positions in three or four months.

Grinding. The work of grinding lenses to the proper thickness and curvature is done on simple machines, which consist of a vertical spindle with an appliance by which different tools may be used. Each style of lens must be ground on a tool made especially for that kind of lens. Convex and concave lenses vary all the way from .12 of a millimeter to 26 millimeters in diameter.

The work of grinding consists in holding the lens firmly and evenly on the tool as the spindle is in motion. This is done by means of a lever fastened to a frame which projects seven or eight inches above the top of the tool. A steel pin is set in the lever so as to be easily brought into place directly over the spindle. By taking the lever in one hand the worker can press down on the lens with as much force as is necessary to grind it properly. As was mentioned in the discussion of the manufacture of lenses, an emery composition is used for grinding purposes. It is moistened with water and constantly applied to the tool as the machine is in motion.

The only educational qualification required is that one be able to read simple instructions. It takes the average person six months or more to learn the operation. The work can be done while the operator is seated, though most workers prefer to stand at least part of the time. A man who had lost one or both legs would be able to do efficient work without difficulty. Two arms are probably required, though the loss of one arm below the elbow might not be a serious handicap providing the person had a suitable appliance. If an operator has lost one arm below the elbow, the other hand should be practically perfect in order to adjust the tools without loss of time. Deafness, weak kidneys, or hernia would not incapacitate one. Normal lungs, healthy skin, and good eyes are necessary for this work. Wages range from $15 to $23 per week.

Polishing. After the lenses have been ground to the desired thickness and diameter they are taken to polishing machines where all rough scratches are removed from the surface of the lens. These machines are very similar to grinding machines though rouge is used instead of emery. Polishing is not as difficult to learn as grinding, so, as a rule, workers advance from blocking on to polishing and from polishing to grinding. The average man can learn polishing in three or four months, but, as a rule, it takes a year or more to earn the highest wages. The work bears practically the same relations to handicaps as that of grinding. Wages range from $15 to $20 per week.

Automatic Grinding and Polishing. Descriptions of grinding and polishing as given above apply to the work on plain and spherical lenses. Toric or cylindrical lenses are ground on automatic machines which are quite complicated in construction but made so as to need little care while in operation. They differ primarily from the spherical grinding machines in that the hand lever of the latter is replaced by an automatic appliance which holds the lens on the tool. The appliance is so constructed as to give a double motion to the lens which is necessary in order to finish it with two curvatures of unequal radii on the same surface. The purpose of the toric lens is to overcome the astigmatism of the eye. This is done by grinding the outer part at a sharper curvature than the inner part of the lens.

One operator can care for five or six machines. The principal work is to keep emery on the tools and to see that the automatic arm is properly adjusted. The average person can learn to operate the machine in three or four months. The worker recognizes by the sound whether or not the machines are working properly, hence normal hearing is a necessary qualification. The loss of a leg, an arm, a hand, or three fingers or less on one or both hands would not incapacitate one. On account of the fact that the work is wet and dirty, it is not suited to men with lung trouble or skin diseases. Wages vary in different plants and range from $15 to $22 per week.

Picking-Off and Washing. After the lenses have been polished they are placed in cold water which chills the pitch and makes it possible to remove the lens from the block without injury to the lens. After the lenses are removed from the block, they are washed through a weak solution of acid and rinsed in clear water. Sometimes it is necessary to use benzene or alcohol to remove all traces of the pitch from the lenses. A new man can take up the work immediately and within a few days' time be able to earn from $18 to $20 per week. The loss of a leg either above or below the knee, a stump of a hand, defective hearing, trunk injuries, or hernia would not interfere with efficient work.

Testing and Gauging for Thickness. After the lens has been washed it is tested for power and gauged for thickness. Most plants employ women for this work. The wages range from $10 to $15 per week. The inspector must know whether the lens is of uniform curvature and thickness. For measuring curvature a simple tool is used, which consists of a round case about the size of a watch supporting three points in a straight line. The outside points are stationary while the middle one is movable and attached to a needle which indicates the diameter as the point follows the surface of the lens. The work can be learned in a few weeks and pays from $10 to $15 per week.

Lining Up. The lenses that pass inspection are taken to another operator who marks on the lens the optical center and draws a line indicating the axes of curvature. This is done by simple instruments which the average person can learn to operate in a few weeks' time. The work is done at a table and offers splendid opportunities for legless men or men who have defective hearing, trunk injuries, arrested tuberculosis, paralysis, or hernia. Some companies employ girls at this operation. Wages range from $10 to $12 per week.

Cutting. After the lenses have been lined up, they are cut to approximately the desired size and shape. This is done on machines with diamond cutters. The lens is held firmly on a revolving plate which is adjusted so as to move underneath the stationary diamond cutter in such a way as to cut the lens according to the shape desired. The lens is cut about half-way through by the diamond cutter and then broken off the rest of the way by means of hand pliers. This work is not difficult and may be learned by the average person in two or three months' time. The operator is seated at a table so that the loss of one or both legs would not be a serious handicap. Two arms, two hands, and at least six fingers are necessary for rapid work. Deafness, trunk injuries, or hernia would not interfere with satisfactory work. Wages range from $12 to $20 per week.

Drilling. Lenses which are to be mounted without rims must have holes drilled in them to receive the screws by which the finger-pieces are fastened on. For this work small drilling lathes are used. Different styles are found in different plants but the usual style is a lathe with an upright drill which works in contact with a round table. The function of the table is to support and hold the lens firmly during the operation. A device is attached to the table which enables the operator to adjust the different styles of lenses to the lathe without loss of time. In some shops the man who does the cutting does the drilling also. The operation pays the same wages and bears the same relations to handicapped men as that of cutting.

Automatic Edge Grinding. After the lenses have been cut to approximately the desired size, they are put on automatic grinding machines, which grind them to the exact size. These machines consist of a lathe adjusted to a grindstone. Appliances are arranged by which the lens can be set on a pattern which determines the extent to which the lens may be ground. When the lens is ground to the same size as the pattern the grinding automatically ceases.

The average employee can learn to do the operation in three or four months. As one man takes care of several machines, a considerable amount of walking is necessary. For this reason injuries to the lower extremities, while not incapacitating one, would probably interfere with satisfactory work. The loss of two or three fingers on either hand, defective hearing, trunk injuries, or hernia would not interfere with one's efficiency. Wages range from $10 to $20 per week.

Hand Edge Grinding. After the lenses come from the automatic grinding machines, the edge is rounded if the lens is to be mounted without a frame and beveled if mounted in a frame. The work is done by hand and requires the deft use of the fingers. The loss of one leg, defective hearing, trunk injuries, hernia, or arrested tuberculosis would not interfere with efficient work. Wages range from $15 to $23 per week by piece-work.

Mounting. From the hand-edging machine the lenses go to the mounting-room where the lenses are set in frames or on finger-pieces. The worker is seated at a table so that the loss of one or both legs would not be a handicap. The use of both hands is necessary though the loss of one or two fingers would not be serious. Deafness, trunk injuries, hernia, or arrested tuberculosis would not interfere with satisfactory work. Women receive from $10 to $18 per week while men average from $18 to $22 per week.

Final Inspection. From the mounting table the lenses go to the final inspector. This work consists in testing lenses for uniform thickness, focusing power, and proper mounting. Testing lenses for focusing power is sometimes done by testing machines but usually by comparison with standard lenses. In the latter case the inspector takes a standard lens and looks through it at an object in the room and then looks at the same object through the lens which is being tested. If the result is the same, the lens is passed. Inspecting requires long experience as inspectors must be perfectly familiar with good workmanship in connection with the frames as well as with the lenses. A person, as a rule, must have worked in the shop two or more years before he can be a final inspector. As the work is done while the operator is seated at a table, the loss of one or both legs would not be a handicap. Two hands are necessary though the loss of two or three fingers would not interfere with good work. Men inspectors receive from $25 to $27 per week.

Washing and Wrapping. After the glasses pass the final inspector they are washed in a disinfectant solution and each pair is wrapped separately for shipping. Even when the customer orders cases as well as glasses the two are packed and mailed separately as the glasses cannot be packed safely for shipping in cases. In most shops women do the work of washing and receive from $10 to $12 per week.

Mailing. As most of the work of the prescription shops is the filling of individual orders, glasses are, as a rule, mailed in single pairs. The work of mailing is light and offers suitable employment for men who have lost an arm, a leg, or who have defective hearing, trunk injuries, hernia, or arrested tuberculosis. Most plants at the present time employ women at this operation, and wages range from $12 to $25 per week.

BIFOCAL LENSES

A bifocal lens is one that has two focusing powers. This may be secured in one of two ways: First, by cementing a small lens with a different focal power to the lower part of the lens; and second, by fusing a segment on to an ordinary lens. The bifocal lenses made according to the last method are called kryptoks.

Several of the operations involved in making kryptok lenses are very similar to those described under the making of spherical lenses. They will be enumerated in this discussion, however, so that the complete process of making kryptoks may be clearly seen.

Laying Out. This operation is the same as the laying out of spherical lenses though, as a rule, it is done by the one who specializes on kryptok lenses.

Blocking-On. The large lens is fastened on to a small block which enables the operator to grind a small hole in the lower part of the lens rather than to surface the entire lens. The hole is made a little larger than the segment which is to be fused on to the large lens. While the work is very similar to that of spherical lenses, it is more particular and requires a worker of considerable experience.

Grinding Hole. The first step after blocking on is to grind a hole in the large lens which is to receive the segment. The work is done on a machine similar to those used in the spherical department but with tools adapted to this special work. It requires six months or more for one to be able to do this work.

Picking-Off. After the hole has been ground to the proper depth, the lens is placed in cold water which chills the pitch so that the lens is easily removed from the block. The man who does the picking-off usually washes the lens, using for this purpose a mild solution of acid or benzene.

The operations mentioned above are done in most shops by the men who work on spherical lenses. They, therefore, bear the same relation to wages and handicapped men as the same operations described in the discussion of spherical lenses.

Fusing Kryptok Lenses. For the purpose of fusing the segment on to the large lens small fusing furnaces are used. These consist of brick ovens encased in metal coverings and heated by a gas flame. The large lens must be carefully cleaned and dried before the segment is set in place. The heat is turned on gradually and, after the segment, which is composed of softer glass than the large lens, melts sufficiently to just begin to run, the operator moves it back and forth in the hole so as to expel all air from between the two lenses. After this is done, the heat is gradually increased until a temperature of from 1200 degrees to 1300 degrees Fahrenheit is reached. This temperature is maintained until the small lens melts enough to run over the edge of the large lens. The heat is then turned off and the furnace is closed tightly and the lenses are left to cool gradually in the furnace. To remove the lenses before they are well cooled would, in most cases, result in impairing their efficiency. It takes from five to six hours' time to fuse one set of lenses.

This work is light and attractive and could be done by one who had lost a leg or an arm. Trunk injuries, hernia, defective hearing, the loss of one eye, or stiffness of joints would not seriously handicap one. Wages have not been standardized but foremen will gladly state the wages which are being paid at the present time on application.

Grinding and Polishing. After kryptok lenses have been fused, they are ground on ordinary grinding machines until the surface of the part fused on is perfectly smooth with the larger lens. The curvature of the fused part is exactly the same as that of the lens proper; the difference in power is due not to difference of curvature but to a difference in the quality of the glass. As the segment is made of softer glass than the lens proper, it is of a stronger focusing power.

Kryptoks are more expensive than cemented bifocals though they are, no doubt, much more durable.

Opportunities for Handicapped Men. As the number of workers employed in making kryptok lenses is very small in proportion to the whole number of workers in optical manufacture, the opportunities for handicapped men are few in number. A disabled soldier who has had previous experience in optical manufacture would find that work in connection with kryptoks offers desirable opportunities. Handicaps of all types except the loss of the use of fingers and blindness would be able to do the work without loss of efficiency.

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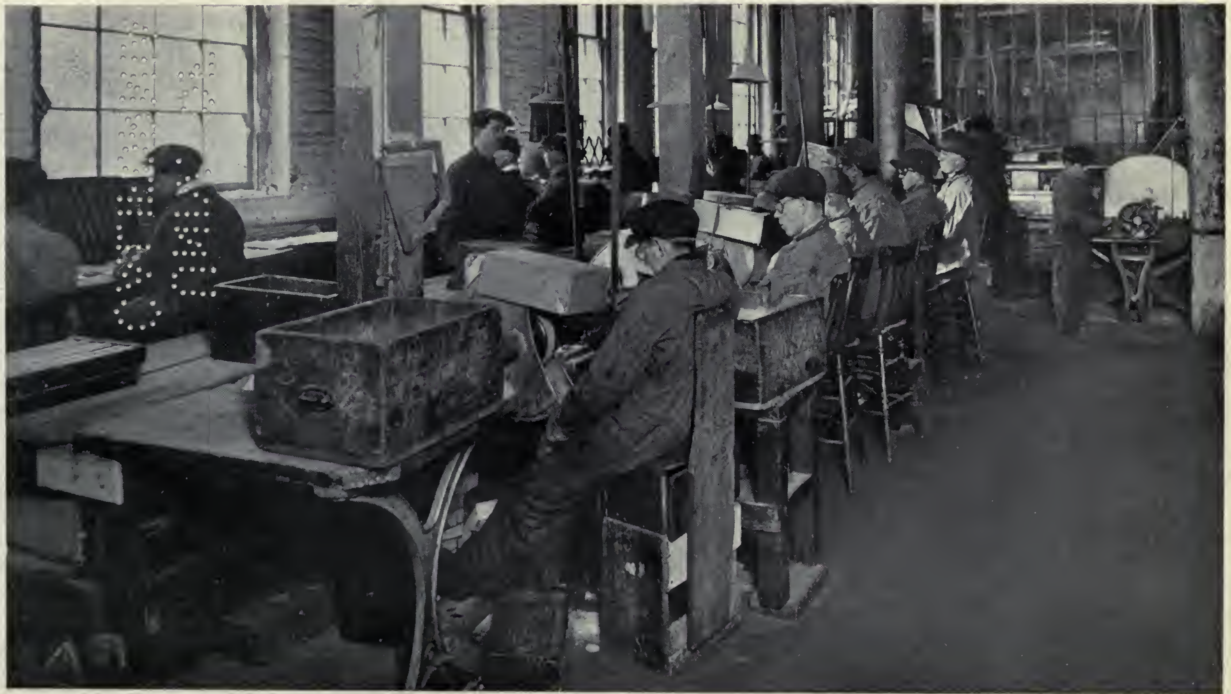
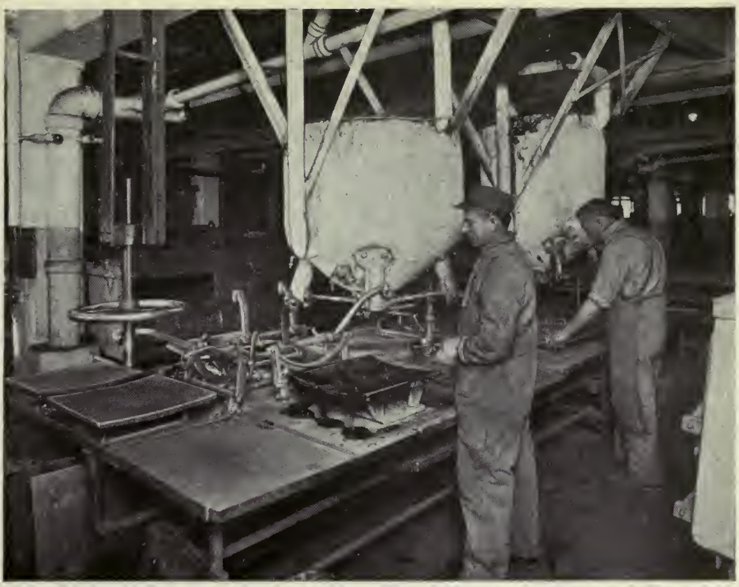
Receiving room for glass stock

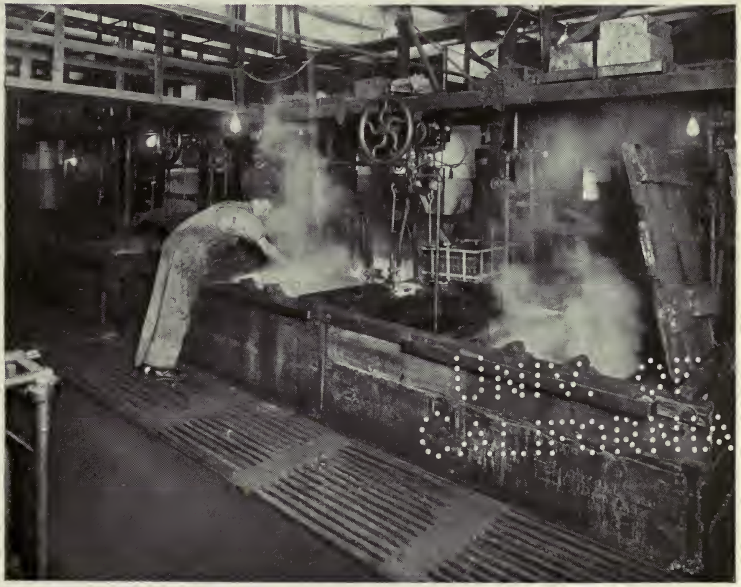
Mixing emery compounds. At the left is the machine used for different grades of emery



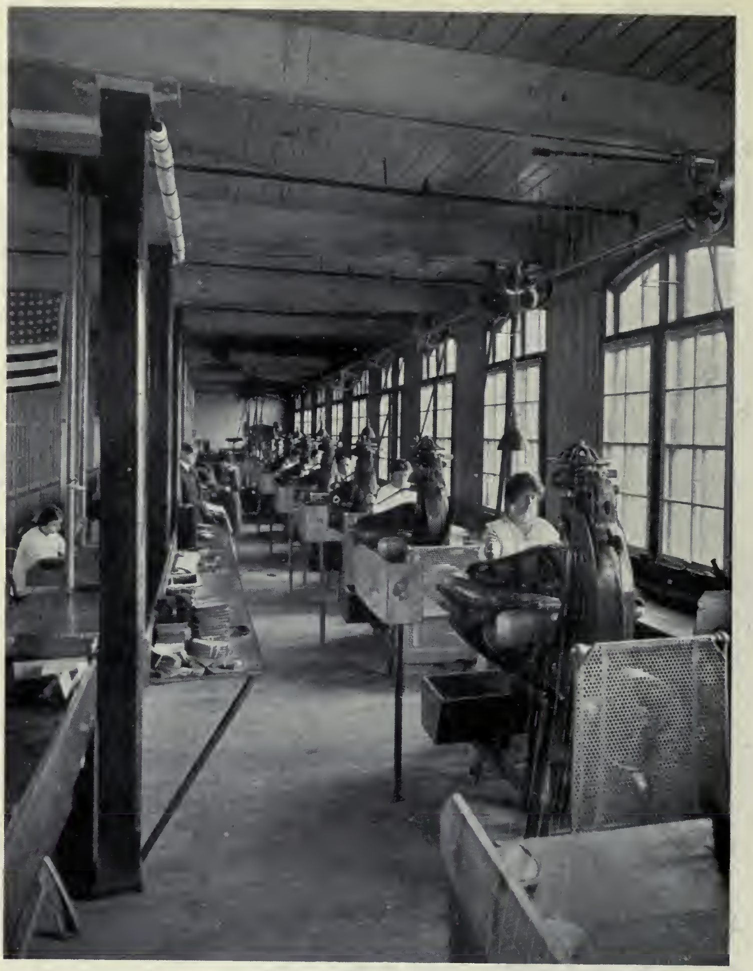
Removing rough edges from molded lenses



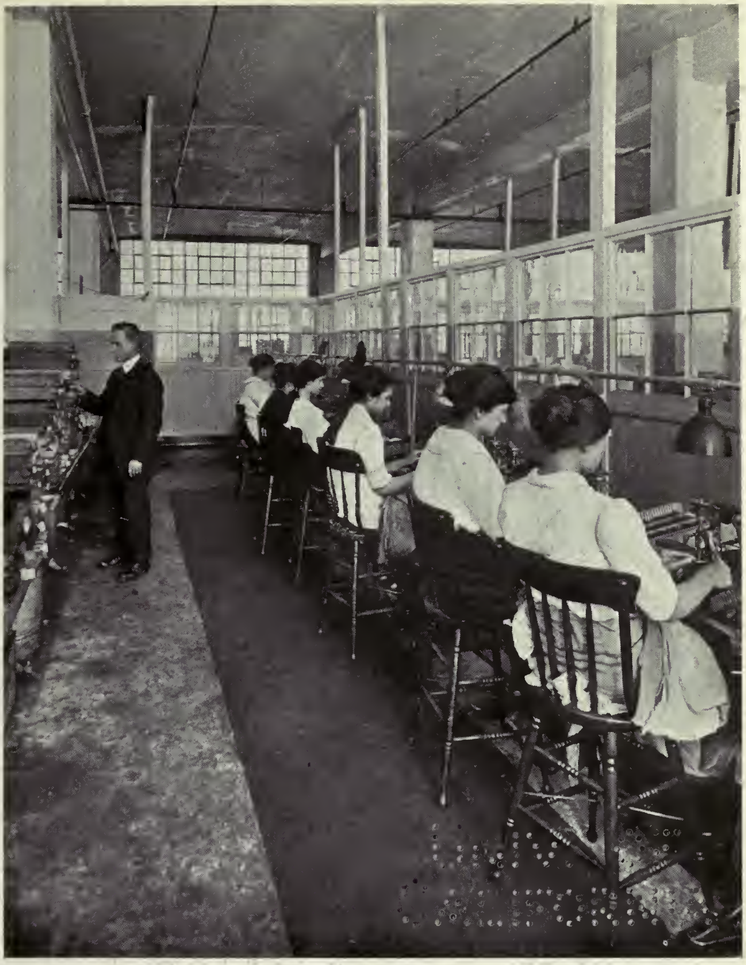
Blocking lenses. Lenses are fastened to concave or convex blocks with pitch which is contained in the large suspended tanks



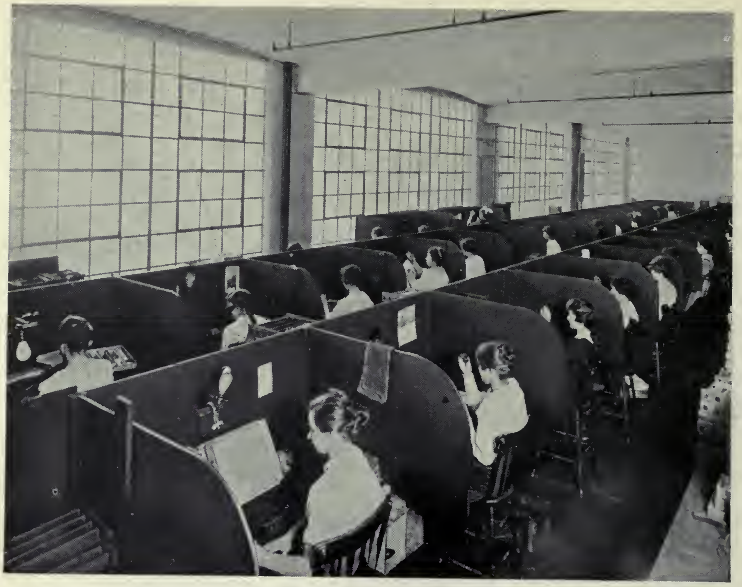
Washing lenses



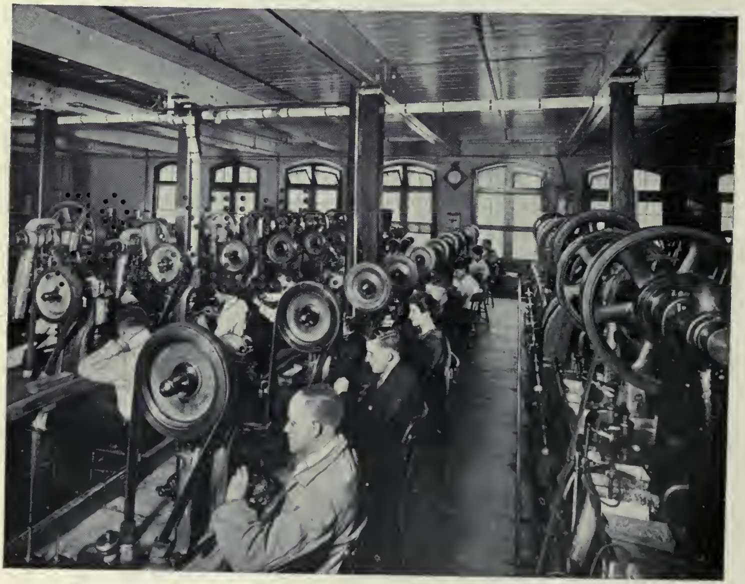
Cutting out leather for spectacle cases. Safety guards eliminate practically all risk of accidents



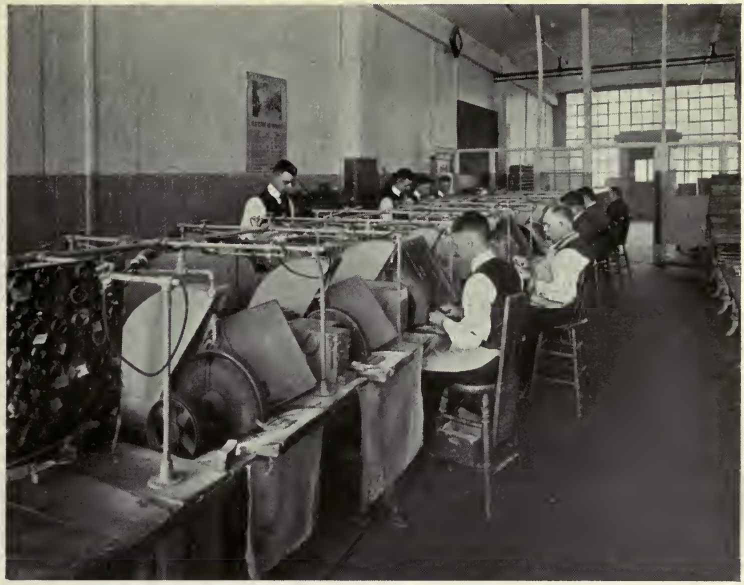
Drilling holes. Lenses to be mounted without frames have holes drilled near the edge for finger and temple pieces



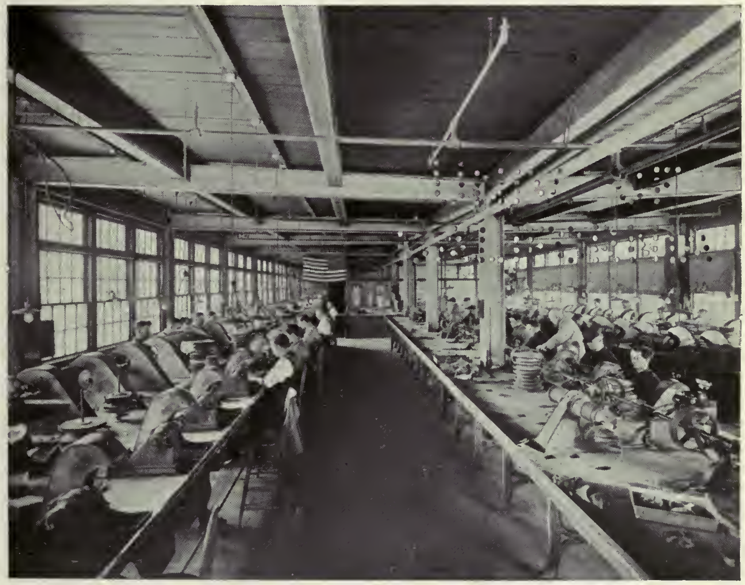
Inspecting lenses



Cutting out small parts. Bench presses used in cutting out small parts for spectacle and eyeglass frames



Operating hand edge grinding machines



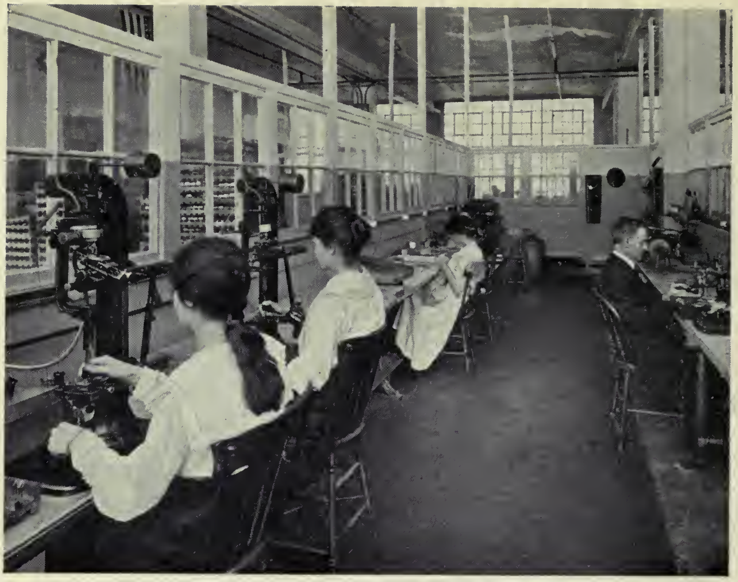
Making and polishing steel parts for eyeglasses and goggles

Making shell-ware frames

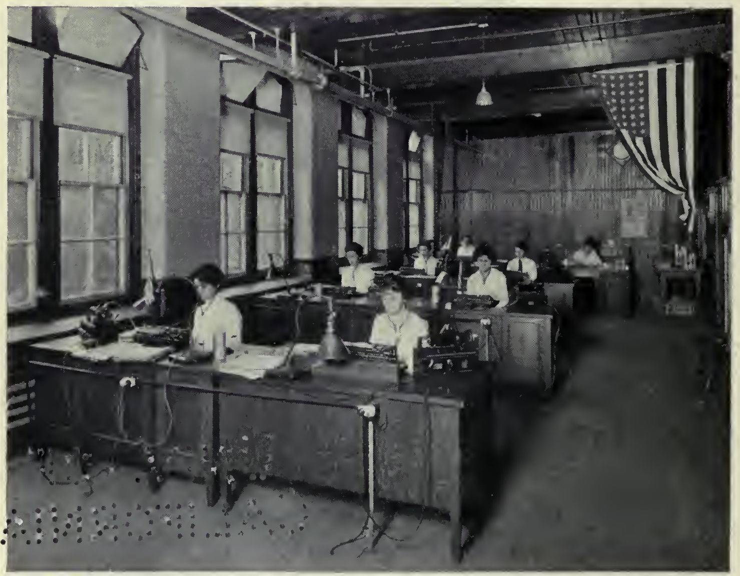
Drawing gold wire for spectacle and eyeglass frames

Mounting finger pieces

Assembling goggles



Embossing monograms on lenses



The dictaphone section of the office. This represents about the only type of position open to the blind

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